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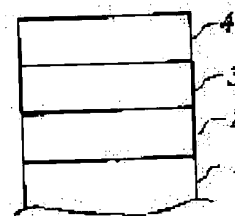
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(54) NON-DEFILM TYPE LUBRICATING COATING STEEL PLATE WITH NO USE OF PRESS OIL

(57)Abstract:

PURPOSE: To develop the non-defilm type lubricating coating steel plate with no use of a press oil having the lubricating performance excellent in processability and having on degradation in the film due to processing by applying and baking the chemical conversion film such as a chromate film and the water-based lubricating coating consisting of a specified composition on the surface of a steel plate.

CONSTITUTION: The chemical conversion film 3 such as the chromate film having 5-100mg/m<sup>2</sup> Cr coverage or the phosphate film having 0.2-2.0g/m<sup>2</sup> coverage, is formed on the surface of the steel plate 1 coated with Zn plating 2. Then the water-based lubricating coating, which is the mixture of 50-85wt. % (a+b) expressed in terms of total solid matter, where (a) is a water-based ether-ester type urethane resin having a bisphenol type skeleton, an ester skeleton and carboxy group of 10-50 acid value and (b) is



an epoxy resin having a glycohol skeleton or the bisphenol type skeleton, 3-30wt.% polyurethane wax(c) having 0-30 saponification value and 70-160°C melting point and 10-40wt.% fine silica (d) having 3-30nm grain size, is applied on the chemical conversion film as the second layer 4, and baked, and the film having 0.2-5µm thickness is formed.

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## DETAILED DESCRIPTION

## [Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the surface treated steel sheet used for parts, such as use \*\*\*\*\*, building materials, and an automobile, after press working of sheet metal, without removing a lubricous coat.

[0002]

[Description of the Prior Art] The conventional parts were processes which apply a press oil, and remove and manufacture the oil after press forming. However, the needs of the surface treated steel sheet which has the surface characteristics (appearance, corrosion resistance, paint adhesion, etc.) excellent in the coat after use regulation of a degreasing solvent, and the lubricous performance which can carry out a press oil ellipsis aiming at cost reduction and a press are strong. this invention offers the epoch-making lubricous plating steel plate which can reply to these needs. As open technology related to this invention, there is JP,3-16726,A "the lubricous resin-treatment steel plate which was excellent in the moldability." This steel plate is Cr coating weight 200 mg/m<sup>2</sup> to the front face of the alloy-plating steel plate of a zinc system or an aluminum system. It is [ the following clo mate coats and ] 0.3 - 3.0 g/m<sup>2</sup> on it. It has a resin coat and it is said that resin coats are the resin 100 weight section which has a hydroxyl group and/or a carboxyl group, a silica 10 - 80 weight sections, and below the polyolefine wax 20 weight section of 1-7 micrometers of mean particle diameters. It is indicated that application of the kind of broad resin is possible for this lubricous steel plate.

[0003] However, neither actual high-speed continuation crank-press processability nor coat degradation after processing is satisfied with a few viewpoint, and is inadequate, and the lubricous steel plate which can be operated stable is obtained for the first time by optimizing the coat which consists of a resin, a silica, and lubricant. Especially, with a non-removing-of-coating type lubricous steel plate, the appearance and the performance after processing are important and the homogeneity of the thickness of a lubricous coat, stretch, compression, and sliding abrasiveness must be taken into consideration.

[0004]

[Problem(s) to be Solved by the Invention] this invention has the lubricous performance excellent in the high-speed deep drawing by the crank press, buckling-of-track processing, flange forming, and bending nature, and aims at offer of a press oil omissible non-removing-of-coating type lubricous plating steel plate degradation of the coat by processing excelled [ offer ] in the property of versatility few.

[0005]

[Means for Solving the Problem] this invention solves the technical problem of the conventional technology advantageously, and is the Cr coating weight 5 - 100 mg/m<sup>2</sup> as the 1st layer to the front face of (1) plating steel plate. A clo mate coat or coating weight 0.2 - 2.0 g/m<sup>2</sup> The Chemicals coat of the acid chloride coat which does not get, The total (a+b) of a water ether ester type urethane resin (a) and an epoxy resin (b) which has a bisphenol type skeleton, an ester skeleton, and a carboxyl group as the 2nd layer receives a total solid. 50 - 85 % of the weight, The press oil omissible non-removing-of-coating type lubricous plating steel plate with which a polyolefine wax (c) is characterized by preparing

the coat of 0.2-5 micrometers of thickness which applies and prints and can obtain the aqueous lubricous paint with which the silica (d) which is the particle size of 3-30nm makes a principal component 10 - 40 % of the weight three to 30% of the weight.

[0006] (2) The weight ratios of the polyether skeleton to the polyester skeleton of an ether ester type urethane resin (a) are 10:90-70:30. and the press oil omissible non-removing-of-coating type lubricous plating steel plate of the 1st publication of a claim characterized by the acid numbers of the aforementioned urethane resin being 10-50 -- and (3) An epoxy resin (b) is the type which has a glycol skeleton or a bisphenol skeleton bisphenol type skeleton. It is the press oil omissible non-removing-of-coating type lubricous plating steel plate of the 1st publication of a claim characterized by blending (b) with 20 - 100% of the weight of the carboxyl group of (a) by the ratio which reacts.

[0007] (4) The press oil omissible non-removing-of-coating type lubricous plating steel plate of the 1st publication of a claim characterized by the melting points of a polyolefine wax (c) being 70-160 degrees C and the particle size of 0.1-70 micrometers.

(5) The press oil ellipsis non-removing-of-coating type lubricous plating steel plate of the 1st publication of a claim characterized by for the saponification value of a polyolefine wax (c) being 30 or less and 0, and being the structure of having branching.

[0008]

[Function and Example(s)] The press oil omissible non-removing-of-coating type lubricous plating steel plate of this invention is the structure of the coat shown in drawing 1. That is, it is the coat structure which consists of the plating coat 2, a clo mate or a Chemicals coat 3 of a phosphoric acid salt coat, and a lubricous coat 4 on sheet steel 1. Each coat can take the composition from which the thickness of both sides, one side, or the front reverse side and coat composition differ according to a use. moreover, a lubricous coat -- 0.2-5.0 micrometers of resin + silica + polyolefine waxes, and the Chemicals coat -- mg [ of Cr(s)/ 5-100 ], and m2 or the phosphoric acid salt 0.2 - 2.0 g/m2, and plating -- the plating of Zn, Zn alloy, aluminum, and aluminum alloy, the amount 1 of plating - 200 g/m2 from -- it changes this invention is fundamentally applicable to an all sheet steel, i.e., aluminum-killed-steel board, super-low carbon-steel-plate, and high tension steel plate. Composition of the typical steel which applied this invention is shown in Table 1.

[0009]

[Table 1]

表 1

	C%	Si%	Mn%	P%	S%	Al%	Ti%	Nb%
アルミ キルト鋼	0.04~ 0.08	≤0.01	≤0.1	≤0.03	≤0.01	0.01~ 0.10	—	—
極 低炭素鋼	≤0.004	≤0.03	≤0.2	≤0.01	≤0.01	0.01~ 0.03	0.04~ 0.06	0.007 ~ 0.02

[0010] Plating kinds are the zinc obtained by electroplating, hot dipping, and the vapor plating, zinc-alloy plating and a double layer plating steel plate, aluminum, aluminium alloy plating, and a double layer plating steel plate. Especially the amount of plating can use the plating steel plate which does not need to limit and is usually used. As a Chemicals coat, a clo mate coat or a phosphoric acid salt coat is used. The Chemicals coat is located between a plating side and a lubricous coat, and gives the adhesion at the time of processing, corrosion resistance, etc. A clo mate can adopt the no rinsing type application clo mate coat which applies the post-rinsing type etching clo mate liquid which makes a principal component post-rinsing [ which makes a chromium hydration oxide a principal component ] type an electrolytic reduction clo mate, chromium, and a hexavalent chromium hydration oxide, and is dried. coating weight -- Cr conversion -- 5 - 100 mg/m2 it is . 5 mg/m2 In the following, since corrosion resistance is not acquired, it is not desirable. 100 mg/m2 In \*\*, adhesion is not obtained that it is easy to produce a clo mate's own cohesive failure. As for a clo mate coat, what it is hard to dissolve in a

drainage system lubricous paint with high chromium / hexavalent chromium ratio is desirable.

[0011] A phosphoric acid salt coat consists of phosphate, such as zinc, iron, nickel, manganese, and calcium. Coating weight is 0.2 - 2.0 g/m<sup>2</sup>. The range is desirable at the reason of corrosion resistance and adhesion. 0.2 g/m<sup>2</sup> Corrosion resistance is not acquired in the following. 2.0 g/m<sup>2</sup> As for super-\*\*, adhesion is not obtained by severe processing by the cohesive failure of a phosphoric acid salt coat.

[0012] The lubricous coat of this invention is explained below. The first feature of this invention is to combine the resin of a kind suitable as a base resin by the fixed weight ratio. It is necessary to make it as a resin the component which maintained adhesion, elongation, the shear strength, corrosion resistance, abrasion resistance, and chemical-resistant balance. In order to satisfy these performances, the combination use of equipment of the resin of this invention is desirable. Although this invention persons had attained acquiring strong processability and corrosion resistance by already blending a urethane resin and an epoxy resin, and blending a specific polyolefine wax, they found out demonstrating the especially excellent performance by specifying the structure of a urethane resin further wholeheartedly as a result of research.

[0013] In order to attain high processability and high corrosion resistance, a paint film is uniform, and it is a premise that adhesion is excellent and it is important that intensity and elongation can be balanced. It is easy to control physical properties more fundamental than the film made according to bridge formation of the resin of low molecular weight by using together a urethane resin with large molecular weight, and an epoxy resin, and is 0.3 - 6 g/m<sup>2</sup> in the amount of paint films. The thin film also found out that uniform physical properties were easy to be acquired. In addition, the urethane resin of low molecular weight is the object of the kind containing the cross linking agent of various isocyanate systems. Especially the combination of the resin system which blended the epoxy resin which was excellent in improvement in the urethane resin excellent in with a molecular weight of 3000 or more abrasion resistance, adhesion, or film intensity as a resin is a base resin suitable for demonstrating many properties, such as high processability and corrosion resistance.

[0014] The urethane resin of this invention is a water-dispersion ether ester type urethane resin (a) which molecular weight has a bisphenol type skeleton and an ester skeleton or more by 3000, and has a carboxyl group, and an epoxy resin (b) is a type which has a glycol skeleton or a bisphenol skeleton, and is blended by the ratio to which 20 - 100% of the carboxyl group of (a) is made to react. The uniform membrane formation nature in a thin film is obtained by using the macromolecule urethane resin of this invention, although the purpose of this invention is attained, the elongation of a paint film is 100% or more more preferably, and tensile strengths are 100 kg/cm<sup>2</sup>. If the resin which becomes above is applied, the highest high processability will be acquired.

[0015] Generally, since control of the physical properties of a urethane resin is performed by the balance and crosslinking density of a hard segment and a soft segment, an extensive property is controllable by the kind of the skeleton constituted and isocyanate. If the elongation of a urethane resin and the adjustment of a tensile strength which are used for this invention are controlled by the content of the ether skeleton which shows the ester skeleton which shows flexibility, and tough nature, and the urethane-bond section and its latter content increases, although elongation is small, the tough property that a tensile strength is high will be acquired. In order to demonstrate especially excellent lubricating properties, the performance in which especially the thing in which a polyester skeleton and an ether component have a bisphenol skeleton excelled the polyester skeleton independent urethane resin which has a numeric value of the same grade as the resin physical properties of this invention is shown.

Adhesion not only with the elongation and intensity of a resin but a base is easily guessed from it being a factor with big lubricity that what has a bisphenol skeleton is excellent in resin physical properties of the same grade at lubricating properties. The range of 10:90-70:30 has the desirable weight ratio of a polyether skeleton and a polyester skeleton. When there are more ratios of a polyether than the above-mentioned range, since tough elongation is small, it is inferior to advanced fabricating-operation nature.

[0016] Although the urethane-resin system which made 3000 or more molecular weight macromolecule-ize the polyol of the ether and ester by the isocyanate carries out self-membrane formation by heating, it has a method of blending the epoxy resin which has reactant functional groups (a hydroxyl group, epoxy

group, etc.) as a method of raising processability, chemical resistance, and corrosion resistance further as a paint film performance, carrying out heating bridge formation, and raising functionality. It newly found out that processability, corrosion resistance, and chemical-resistant large improvement could be aimed at from the denaturation object independent membrane formation method that this method performed epoxy denaturation of a urethane resin. Even if this crosslinking reaction blends an isocyanate compound or an amino compound etc. which was put together and which is called curing agent by the need although at least a resin system advances, it is not cared about.

[0017] Although a polyol, a polyoxy tetramethylene glycol, etc. which added an ethyleneoxide, propylene oxide, etc. to low-molecular glycols, such as ethylene glycol, a propylene glycol, and bisphenol A, are mentioned as a polyether polyol of the urethane-resin skeleton used for this invention, the polyether polyol which has especially the bisphenol A skeleton is suitable. The lactam polyols which carried out ring opening polymerization of the lactams, such as polyester obtained by the dehydration condensation reaction with low-molecular glycols and dibasic acid and an epsilon caprolactam, under existence of a low-molecular glycol as a polyester polyol are mentioned.

[0018] As an isocyanate machine which combines the ester skeleton and ether skeleton of a urethane resin The monomer of aromatic diisocyanate, such as TORIRE diisocyanate, diphenyl metadiisocyanate, and xylylene diisocyanate A reactant with a dimer, a trimer and them and a polyether polyol, a polyester polyol, etc., And the alicycle group isocyanate, isophorone diisocyanate which are those hydrogenation derivatives, Reactants with alicycle groups, such as hexamethylene di-isocyanate, and the monomer of an aliphatic isocyanate, a dimer, a trimer, a polyether polyol, a polyester polyol, etc. and those mixture can also be used. Although loadings are based on the polyester polyol to be used, a polyether polyol, and the molecular weight and the ratio of a carboxyl group introduction component which are mentioned later, 5 - 20% of the weight of a urethane resin can obtain the working characteristic optimal as resin physical properties by NCO conversion.

[0019] A carboxyl group demonstrates a big contribution to adhesion with a surface of metal while being a functional group for carrying out self-emulsification. As an introductory component of a carboxyl group, it is a compound containing two or more hydroxyls or the amino group, and one or more carboxyl groups, and diamino carboxylic acids, such as dihydroxy carboxylic acids, such as 2 and 2-dimethylol propione acetic-acid, 2, and 2-dimethylol-propionic-acid, 2, and 2-dimethylol butanoic acid, 2, and 2-dimethylol pentanoic acid, and a lysine, an arginine, are mentioned. The carboxyl group compound chosen from these is macromolecule-ized with an isocyanate compound in combination with the aforementioned polyester polyol and a polyether polyol. The ether ester type urethane resin in which the molecular weight used by this invention has 3000 or more carboxyl groups by this method is made.

[0020] The method of neutralizing a carboxyl group with alkali, such as ammonia and a trimethylamine, and carrying out self-emulsification as a method of distributing the aforementioned urethane resin in water, or the method of carrying out emulsion distribution using an emulsifier is mentioned. It is most desirable to collect the solvents contained in the urethane manufacturing process before drainage-system-izing as a cure against a work environment, and to obtain a non-solvent type water dispersing element finally. It is suitable for the amount of a carboxyl group that it is 10-50 in the acid number per urethane solid content. The case of less than ten, adhesion is inadequate and processability and corrosion resistance are inferior. When exceeding 50, since water resistance and alkali resistance are inferior, corrosion resistance falls.

[0021] It is appropriate to blend by the ratio to which 20 - 100% of the carboxyl group of a urethane resin reacts preferably as loadings of the epoxy resin which has reactant functional groups (a hydroxyl group, epoxy group, etc.). In less than 20%, a blending effect is scarce, and in the amount exceeding 100%, since an epoxy resin serves as a plasticizer-role, advanced processability falls. In addition, chemical resistance and the anti-corrosion disposition top effect of an epoxy resin are large. When the structure which has the bisphenol A type skeleton is used for an epoxy resin, adhesion and especially the anti-corrosion disposition top effect are large. Since a non-solvent type and paint film degradation are prevented as an environmental cure, when an agalactia-ized agent type is required, a water-soluble epoxy resin can be obtained by giving a hydrophilic property by the glycol skeleton.

[0022] It is necessary to determine the loadings of an epoxy resin according to the acid number of a urethane resin, and the calculation method is as follows. The formula which calculated the initial complement of the epoxy resin for carrying out 100% of reaction from the urethane resin which has the predetermined acid number (AV) is a formula 1 noting that the carboxyl group of a urethane resin and the epoxy group of an epoxy resin react with the equivalent.

(Formula 1)

Area-velocity  $\times (1/56) / 1000 \times \text{weight-per-epoxy-equivalent} \times \text{urethane-resin combination weight of an epoxy solid-content (weight g)} = \text{urethane resin (g)}$

[0023] Although the reactional phase present becomes that the carboxyl group which contributes to adhesion does not have less in order that the epoxy group blended by this invention may construct a bridge with a carboxyl group, since OH basis arises by the ring breakage of an epoxy group, adhesion is secured. Moreover, corrosion resistance also improves greatly by combination of an epoxy resin. Molecular weight is stabilized in the combination of less than 3000 urethane resin and the above-mentioned epoxy resin, and high processability is not attained. Moreover, in membrane formation urethane-resin independent [ with a molecular weight of 3000 or more ], advanced processability and advanced corrosion resistance are not acquired.

[0024] 50 - 85% of the sum total weight of the urethane resin (a) of the drainage system lubricous paint constituent of this invention and an epoxy resin (b) is suitable at the solid-content ratio to a total solid. When exceeding less than 50% of case, and 85%, corrosion resistance and processability are inadequate. However, only with these resin system coats, since the target processability cannot be attained, combined use of a lubricous additive is needed.

[0025] As a lubricous additive, lubricant, such as a well-known fluorine system, a hydrocarbon system, a fatty-acid amide system, an ester system, an alcoholic system, a metallic-soap system, and an inorganic system, is mentioned. It is required from the point that choosing matter which exists in a resin film front face reduces the front face of a molding work, and friction of metal mold rather than existing in the resin film which the added lubricant formed as a selection criterion of the lubricous additive for the improvement in processability dispersedly, and it carries out the maximum exertion of the lubricous effect. That is, when it exists in the resin film which lubricant formed dispersedly, a skin friction coefficient produces the poor appearance and the processability fall which the quality of a powdered material carries out ablation deposition, and are called powdering phenomenon that a resin film is easy to be destroyed highly. As matter which exists in a resin film front face, it does not dissolve in a resin and the small thing of surface energy is chosen.

[0026] When the polyolefine wax was used as a result of this invention persons' examination, it turns out that processability improves greatly and performances, such as corrosion resistance after processing and chemical resistance, are also made good. As this wax, the wax of hydrocarbon systems, such as paraffin, a micro crystalline, or polyethylene, is raised. Since coat temperature rises with the heat by deformation and the frictional heat of a material, at the time of processing, 70-160 degrees C is suitable for the melting point of a wax, and the property which carried out softening fusion and was excellent in less than 70 degrees C as a solid lubrication additive at the time of processing is not demonstrated at it. Moreover, since a stiff particle will exist in a front face and the thing of the melting point exceeding 160 degrees C reduces a friction property, advanced fabricating-operation nature is not obtained.

[0027] Preferably, as saponification value of a polyolefine wax, it is 30 or less and 0, and it is desirable to use what has branching structure. Since it is easy to dissolve polarity in a resin greatly and that to which saponification value exceeds 30 stops being able to exist in a resin front face easily at the time of membrane formation, when advanced processability ability level is required, it cannot be said to be suitable. The saponification value in which especially a desirable thing does not have a smaller ester combination of compatibility with a resin is the wax of 0.

[0028] 0.1-7.0 micrometers is suitable for the particle size of these waxes. Since a distribution of the wax which solidified becomes uneven, the thing exceeding 7.0 micrometers is not desirable. Moreover, in the case of less than 0.1 micrometers, processability is inadequate. The amount of a lubricous additive adds 3 - 30% by the solid-content ratio to the total-solid weight of a lubricative paint. Less than 3% of

case, the improvement effect in processability is small and processability and corrosion resistance fall in the amount exceeding 30%.

[0029] As other additives, it is SiO<sub>2</sub> because of improvement in corrosion resistance. 10 - 40% is added to a total solid. SiO<sub>2</sub> By addition, there are corrosion resistance large improvement and the improvement effect of processability. Less than 10% of case, the improvement effect of corrosion resistance and processability is small, and in the amount exceeding 40%, since the elongation and intensity of a resin fall while the binder effect of a resin becomes small and corrosion resistance falls, processability falls. SiO<sub>2</sub> About particle size, 3-30 micrometers is suitable. When exceeding 30 micrometers, in the case of less than 3 micrometers, more advanced processability and more advanced corrosion resistance are not acquired. As a kind of silica, although there are liquid phase colloidal silica and a gaseous-phase silica, it does not limit especially by this invention. Moreover, for the reason on a conductive object or a design disposition, a color-pigment object may be added for improvement in weldability. Moreover, various additives, such as a sedimentation inhibitor, a leveling agent, and a thickener, can be added.

[0030] Since this invention is the paint of a drainage system, when performing a specified quantity application to the painted surface-ed, since surface tension is high as compared with a solvent system, surface wettability is inferior, and uniform application nature may not be obtained. In order to secure performances, such as advanced processability and corrosion resistance, it is indispensable that a uniform application is performed to \*\*\*\*\*-ed. For this reason, it is well-known to carry out combination addition of a wetting agent or the thickener. The surfactant to which well-known surface tension, such as a fluorine system in which surface tension is reduced, and a silicon system, is reduced as a wetting agent is mentioned. In this invention, especially the thing for which the number of mols of an addition ethyleneoxide contains the acetylene glycol alcohol type surfactant (e) of 0-20 0.05 to 0.5% to a drainage system lubricous paint constituent in these compounds found out the desirable thing. At less than 0.05%, the addition effect is small, and the improvement effect in wettability is saturated with the amount exceeding 0.5%. In addition, it is the feature that an acetylene glycol alcohol type surfactant is damp, and speed has the defoaming effect simultaneously greatly. On the other hand, since the surfactant of a fluorine system and a silicon system is damp although surface tension fall capacity is excellent, and speed is small, and it is inferior to antifoam and finishing paint adhesion is also inferior, it is not suitable.

[0031] Moreover, a thickener may be added as a cure in case film thickness is not secured by the method of application represented by the roll coater, when surface coating nature sufficient by just the wetting agent cannot be secured to the crawling part of the painted surface-ed. Usually, since the paint of this invention is painted by the coated object at high speed, on the coating conditions which receive high-speed shearing stress in the thickener of the CHIKUSO type represented by the cellulose system, its effect is small. It learns by experience and it is well-known on coating conditions [ like ] that a new TONIA type thickener is suitable. As a thickener used for this invention, especially the thickener in which molecular weight has the ether urethane skeleton of 1000-20000 is desirable.

[0032] Since this thickener has the urethane-resin skeleton and compatibility which are the base resin of this invention paint, it shows the new TONIA thickening behavior of meeting nature, and it shows an effective effect with a little addition. Usually, although an original performance is reduced in many cases when blending an additive with a paint, it is the feature that this thickener has the very small influence of [ at the time of remaining in a paint film for the skeleton to which hydrolysis cannot take place easily ]. To the resin solid content of a drainage system lubricity paint constituent, an addition is 0.01 - 0.2% and is usually determined by coating conditions. At less than 0.01%, the thickening effect is small, and since that trouble arises to coating nature since viscosity becomes large too much in the amount exceeding 0.2% and advanced processability, and the outstanding corrosion resistance fall, it is not desirable.

[0033] Drawing 2 is amount of plating 20 g/m<sup>2</sup>. It is Cr coating weight 50 mg/m<sup>2</sup> to an electrolytic zinc-zinc-coated carbon steel sheet. It is as a result of [ of the lubricous steel plate of this invention which applied the lubricous paint of the resin shown in the lubricant which gave the etching clo mate coat and was shown in Table 2, and Table 3, and silica composition, printed on 130 degrees C of attainment



board temperature at the baking furnace, and covered the lubricous coat of 2.5-3.0 micrometers of thickness ] press evaluation. Evaluation of press nature is shown for the kind of lubricant in a vertical axis for a horizontal axis. After evaluation of press nature performed the \*\*\*\* high-speed crank press of 60mm depth, the lightness difference with the standard paper which stuck the normal adhesive tape which exfoliated with adhesive tape, stuck the corner lateral portion on the blank paper, and measured lightness with the color difference meter was searched for. The press crack evaluated the score 6 and, as for the score 5, ten or more lightness differences and the score 1 evaluated one or less lightness difference and scores 4-2 by the gradual criteria which become good. Moreover, at path clearance 5%, 90 L-bending presses were performed, score attachment of the generated press or the \*\* was observed and carried out, flange bending was evaluated, and the black bar graph showed. It is that to which a press or \*\* remained to score x punch and the board at the line, and a not good thing and score O are those to which several point press remained in punch, score O is a good score a press or \*\* is not accepted to be to a board side and punch at all, and there is [ a good thing and score \*\* are what remained in the thin line, and ] a problem in a board side a little.

[0034] Lubricous coat UF-L is the example for which the particle size of 0.04 micrometers and density used the Teflon (PTFE) of 2.2 as lubricant. In the \*\*\*\* crank press, this lubricous coat UF-L was scores 5 and 5, and the L-bending score was x. Lubrication coat UE-1 is the example of this invention for which the particle size of 5.0 micrometers and density used the polyethylene wax of 0.97 as lubricant. In the \*\*\*\* crank press, this lubricous coat UE-L was a score 2.0, and the L-bending score was O. Lubrication coat UE-2 are the example of this invention for which the particle size of 1.0 micrometers and density used the polyethylene wax of 0.92 as lubricant. In the \*\*\*\* crank press, these lubrication coat UE-2 were a score 1.5, and the L-bending score was O.

[0035] Lubrication coat UE-3 are the example of this invention for which the particle size of 0.6 micrometers and density used the polyethylene wax of 0.92 as lubricant. In the \*\*\*\* crank press, these lubrication coat UE-3 were a score 1.0, and the L-bending score was O. Compared with the polyolefine wax of this invention condensing on a coat front face, and the reason which is not good reducing coefficient of friction, that it is hard to condense, it slides in layers in molecular structure, and PTFE can be presumed for exfoliating and being easy to deposit as a press or \*\*. Since the density of lubricant differs from a size, the difference in the press nature of L-bending UE-1 and UE-3 can be presumed to be the difference in the amount of concentration of the wax on the front face of a coat.

[0036] The optimum value of the lubricant in the coat of this invention is explained using drawing 3. A sample is Cr coating weight 36 mg/m<sup>2</sup>. The amount of plating of 20g/m<sup>2</sup> which carried out the electrolytic chromate treatment It is as a result of [ which covered the lubricous coat of 2.5-3.0 micrometers of thickness to the nickel zinc-alloy plating steel plate 12% ] a press. A dynamic friction coefficient and a coefficient of static friction are shown for the concentration (%) of the lubricant in a coat in a vertical axis for a horizontal axis. The dynamic friction coefficient measured the force horizontal at the load cell which you apply [ load cell ] a 100g load to a semisteel sphere with a diameter of 10mm, and makes it move to it by per minute 10mm, \*(ed) it by the load, and was taken as coefficient of friction. Moreover, a coefficient of static friction calculates coefficient of friction from the angle on which set 100g weight on the front face of a lubricous steel plate, the angle board of per second 10 degrees is made to incline, and weight begins to slide. - That O- showed showed the coefficient of static friction of this invention which used the polyethylene wax as lubricant. It begins to fall at about 2%, and becomes 0.12 at about 13% on the front face on which it is easy to slide. - It is the result of using PTFE as lubricant, and, as for \*\*-, even 17% of addition showed the high coefficient of static friction compared with 0.15 and the polyethylene wax. - That -- showed showed the dynamic friction coefficient of this invention which used the polyethylene wax as lubricant. It falls to 0.12 at 1%, and it is stabilized in 0.06 at 3%, and is stabilized in 0.05 and a low value in addition 5%. - <- showed the dynamic friction coefficient of 0.12 with 17% of content in the example which used PTFE as lubricant.

[0037] The film of the lubricous coat of about 2mm of thickness of this invention was created to drawing 4, and the result which performed the tension test and measured stretch and tensile strength of a lubricous coat was shown. The silica content in a coat is prolonged at 10%, and, for stretch, 240%

tensile strengths are 250 kg/cm<sup>2</sup> in 450% tensile-strength 50 kg/cm<sup>2</sup> and 38% of silica content. It was good. It is prolonged at 50% of silica content, and deteriorates with 100%, and tensile strengths are also 170 kg/cm<sup>2</sup> by coat fracture. It fell and coat physical properties fell.

[0038] The lubricity the direction where the \*\*\*\* crank press and the L-bending score have been improved, and the direction which used the polyolefine wax as lubricant for the above reason specified the polyolefine wax concentration in a coat to 3 - 30% excelled [ lubricity ] in coefficient of friction low is obtained. The coat the direction which specified the silica content in a coat to 10 - 40% excelled [ coat ] in stretch and tensile-strength balance is obtained.

[0039] The thickness ranges of the lubricous coat of this invention are 0.2-5.0. Although differing and limiting according to the gestalt of a press is difficult for the optimal thickness, the thick film of a thin film is advantageous to deep drawing to L-bending. In less than 0.2 micrometers, a lubricous performance is unstable. It occurs [ blocking or the press of a coil, or \*\* / so much ] in 5.0-micrometer length and is not desirable. The dynamic friction coefficient of the lubricous coat of this invention, thickness, and \*\*\*\* crank-press evaluation which covered the lubricous coat were shown in the chromate treatment plating steel plate of drawing 4 at drawing 5. A dynamic friction coefficient and \*\*\*\* crank-press conditions were performed by the method mentioned above. The score of a \*\*\*\* crank press showed [O] and the thing of marginal level by which galling is accepted and permitted slightly all over drawing by "\*\*\*\*" and the intense thing "x" of galling for the thing without generating of galling by metallic contact of a dice and a sample. In the \*\*\*\* crank press, thickness obtained "\*\*-O" the good result by 0.13 or less dynamic friction coefficient by 2.0 micrometers or more. Moreover, in 1.5 micrometers or less, press appearance with 0.15 or more dynamic friction coefficients and thickness good at score x was not acquired.

[0040] The result which evaluated the same lubricous plating steel plate as drawing 5 about the L-bending press was shown in drawing 6. "x" showed what a press or \*\* generated in the line to the thing or punch with which "\*\*\*\*" side, a board side, or \*\* generated the thing of the marginal level a press or \*\* is accepted to be to small punctiform by [O] and press punch in a thing without a press or generating of \*\*, and which is permitted. 0.15 or more dynamic friction coefficients and thickness occur in 3.0 micrometers or more, and a press or \*\* serves as a defect "x." "Score \*\*-O" was obtained the result with 0.13 or less dynamic friction coefficient and thickness good at 2.75 micrometers or less. From these results, the most desirable thickness range is 2.0 micrometers or less in 2.5 micrometers or more and an L-bending press at a \*\*\*\* crank press.

[0041] The example applied to the hot-dip zinc-coated carbon steel sheet is shown below. Cr coating weight 15 mg/m<sup>2</sup> To the hot-dip zinc-coated carbon steel sheet which carried out \*\*\*\* chromate treatment, the ether ester urethane resin (bisphenol A ether : the acid number 18, the ether / ester ratio 30/70, isocyanate content 8) and propylene-glycol epoxy resin of molecular weight 5000 The lubricous paint which blended with a particle size of 0.6 micrometers polyethylene wax (specific gravity 0.93, softening temperature of 120 degrees C) 13% for the silica sol of 8nm of mean particle diameters 21% was applied to (the weight per epoxy equivalent 220), it printed on 130 degrees C of board temperature, and thickness created the lubricous steel plate (1 micrometer and 3 micrometers). The lubricous steel plate whose obtained thickness is 1 micrometer does not have a press or \*\* at an L-bending press, and the good press nature to which the lubricous steel plate whose thickness is 3 micrometers does not generate galling with a \*\*\*\* press was obtained.

[0042]

[Table 2]

表 2 用いた塗料中の潤滑剤

潤滑被膜の記号	潤滑剤	平均粒径 μm	密度	軟化点 ℃	被膜中の 含有率%
UF-L	P T F E	0.04	2.2	380	17
UE-1	ポリエチレンワックス	5.0	0.97	132	13
UE-2	"	1.0	0.92	113	13
UE-3	"	0.6	0.92	113	13

[0043]

[Table 3]

表 3 用いた塗料中の樹脂、シリカ

樹 脂	シリカ
1. 水分散性ウレタン樹脂塗料 平均分子量 約3万 エーテル/エステル=48/52 エーテルのタイプ: ビスフェノールA 酸価26 イソシアネートNCO換算 9% 2. エポキシ樹脂エマルジョン ビスフェノールA エポキシ当量450	塗料時の平均粒径10nmのゾル 被膜中の含有率25%

[0044]

[Effect of the Invention] It has the lubricous performance which was excellent in the high-speed deep drawing by the crank press, buckling-of-track processing, flange forming, and bending nature with this invention, and degradation of the coat by processing can offer the press oil omissible non-removing-of-coating type lubricous plating steel plate which was excellent in the property of versatility few.

[Translation done.]